

R E M A R K S

Claims 1-5 and 13 are pending in this application. Claims 6-12 have been canceled.

Before specifically discussing the rejection of the claims, it is believed that the following background information should be considered in order to shed a proper light on the development of the present invention and the advantageous features thereof. As discussed in the specification under "Prior Art", polycarbonates, which are light in weight and have excellent impact resistance, have been used in various fields, such as automobile parts, parts for use in household electric appliances and parts for use in office automation machines. However, polycarbonates are easily flammable, and the use of polycarbonates is limited due to their flammability.

As a method for imparting flame retardancy to resins, it is known to add thereto flame retardants, such as halogen-containing flame retardants, phosphorus-containing flame retardants and inorganic flame retardants. The objective of imparting flame retardancy to resins has been attained to some extent by the use of such flame retardants. However, the demand for improved safety in the accident of fire has increased in recent years. In accordance with the increasing demand, studies for developing improved techniques for imparting flame retardancy to resins have been made in the art. In addition, it

has also been desired for these flame retardancy-imparting techniques to have advantages in that no environmental problem is posed or no lowering of the mechanical properties of resins is caused.

Techniques are also known of using organic silicon compounds as flame retardants for resins. For example, Unexamined Japanese Patent Application Laid-Open Specification Nos. 10-139964 and 11-140294 each disclose a flame retardant aromatic polycarbonate resin composition containing a branched methylphenylsilicone and/or a crosslinked methylphenylsilicone. However, due to the branched and crosslinked structures thereof, the above-mentioned methylphenylsilicones exhibit poor compatibility with an aromatic polycarbonate resin. As a result, each of these branched and crosslinked methylphenylsilicones has a problem in that the dispersibility thereof in the resin composition is poor. Further, the aromatic polycarbonate resin composition disclosed in this prior art document has a problem in that the flame retardancy thereof is poor.

Thus, although various flame retardants for an aromatic polycarbonate have conventionally been proposed, no flame retardant has not yet been proposed which can be used for producing a flame retardant aromatic polycarbonate resin composition having not only an excellent flame retardancy but

also excellent mechanical properties.

A methylphenylsilicone having no branched or crosslinked structure is known and used as an oil for a diffusion pump or a high temperature oil bath. However, with respect to this type of methylphenylsilicone, there has been no report suggesting that a polycarbonate resin composition having not only an excellent flame retardancy but also excellent mechanical properties has been obtained by the combined use of the above-mentioned silicone and an aromatic polycarbonate.

In this situation, the present inventor has made extensive and intensive studies with a view toward developing a polycarbonate resin composition which is free from the above-mentioned problems, specifically, a polycarbonate resin composition which is advantageous not only in that it has excellent flame retardancy, excellent melt fluidity and excellent melt-molding stability (i.e., substantially no variation or only small variation in the quality of shaped articles obtained by melt-molding), but also in that it can be used for producing a shaped article having excellent mechanical properties, excellent light stability and excellent appearance. As a result, it has unexpectedly been found that, by using at least one specific, aromatic group-containing silicone compound selected from the group consisting of an aromatic group-containing silicone compound having a linear configuration and

an aromatic group-containing silicone compound having a cyclic configuration, wherein the silicone compound contains an aromatic group in a specific amount, not only can a great flame retardancy be imparted to an aromatic polycarbonate, but also the above-mentioned other properties of an aromatic polycarbonate can be improved. The present invention has been completed, based on this novel finding.

As seen in the Proposed Amendment, in order to more clearly define the present invention, claim 1 has instantly been reformulated into a process claim, which reads as follows:

"A process for imparting flame retardancy to a resin component selected from the group consisting of an aromatic polycarbonate and a resin mixture of an aromatic polycarbonate and at least one organic polymer resin other than an aromatic polycarbonate, wherein said resin mixture has an aromatic polycarbonate content of 50 % by weight or more,

said process comprising adding to said resin component a flame retardant comprising at least one aromatic group-containing silicone compound, wherein said flame retardant is added in an amount of 0.1 to 100 parts by weight, relative to 100 parts by weight of said resin component,

said at least one aromatic group-containing  
silicone compound comprising a monomer, a polymer or a  
mixture thereof, which is represented by the following  
formula (1).....".

Further, in order to more clearly define the present  
invention, by the instant amendment to claim 1, an aromatic  
group-containing silicone compound having **a cyclic configuration**  
**has been excluded from claim 1**, and hence, the aromatic group-  
containing silicone compound used in the present invention has  
been limited to an aromatic group-containing silicone compound  
having **a linear configuration**. In this connection, the  
following should be noted. In the present invention, an  
aromatic group-containing silicone compound having **a linear**  
**configuration is preferred to** an aromatic group-containing  
silicone compound having **a cyclic configuration**. The reason for  
this is as follows. When the molecular weight is the same, an  
aromatic group-containing silicone compound having **a cyclic**  
**configuration** tends to have a boiling point which is lower than  
that of an aromatic group-containing silicone compound having **a**  
**linear configuration**. That is, an aromatic group-containing  
silicone compound having **a cyclic configuration is more volatile**  
than an aromatic group-containing silicone compound having **a**  
**linear configuration**. This means that, during a molding

operation, an aromatic polycarbonate resin composition containing an aromatic group-containing silicone compound having **a cyclic configuration** tends to be susceptible to **bleeding** of the silicone compound (and hence to staining of the inside of the mold), as compared to an aromatic polycarbonate resin composition containing an aromatic group-containing silicone compound having **a linear configuration**.

Turning now to the rejection of the claims, claims 1 to 13 have been rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The rejection is discussed below.

(i) Specifically, first, the Examiner states as follows.

"Claim 1's statement (second to last paragraph) that  $R^1$  and  $R^2$  of formula (2) is H or an aliphatic hydrocarbon, directly conflicts with earlier requirements that some of  $R^1$  and  $R^2$  be aromatic."  
(emphasis added)

The Applicant responds as follows.

By the instant amendment to claim 1, formula (2) has been deleted. Therefore, it is believed that the above-mentioned objection has been removed.

However, attention is drawn to the following. Each of  $R^1$  and  $R^2$  of formula (2) (now deleted) is as defined for formula (1). The Examiner appears to **misunderstand** the definition of each of  $R^1$  and  $R^2$  which appear in formula (1). This point is explained below.

First, it should be noted that the Examiner's recognition that each of  $R^1$  and  $R^2$  of formula (1) is H or an aliphatic hydrocarbon is **wrong**. Each of  $R^1$  and  $R^2$  of formula (1) independently represents a hydrogen atom or a monovalent **C<sub>1</sub>-C<sub>20</sub> hydrocarbon group** (covering both non-aromatic hydrocarbon groups and aromatic hydrocarbon groups). Therefore, any of  $R^1$  and  $R^2$  of formula (1) can be a monovalent **C<sub>6</sub>-C<sub>20</sub> aromatic group**.

It should also be noted that, contrary to the Examiner's statement, claim 1 of the present application does not require that some of  $R^1$  and  $R^2$  be aromatic. Claim 1 of the present application requires that **at least one** of  $R^1$ ,  $R^2$ ,  $R^3$  and  $R^4$  be a C<sub>6</sub>-C<sub>20</sub> aromatic group. Therefore, each of  $R^1$  and  $R^2$  can be non-

**aromatic**, specifically a hydrogen atom or an aliphatic hydrocarbon group.

(ii) The Examiner also states as follows.

"It is confusing/superfluous to include formula (3) as these recurring units were already required in formula (1) and (2)."

The Applicant responds as follows.

The reason why formula (3) is included in claim 1 is that claim 1 has a description reading: "the recurring units.... are the same or different, so that said flame retardant is a homopolymer or a copolymer, wherein said copolymer has a random, a block or an alternating configuration". In view of the presence of such description in claim 1, it is firmly believed that, for clarity, formula (3) should be retained in claim 1.

(iii) The Examiner also states as follows.

"It is not clear how or when 'at least part of said component (B) is a compound represented by formula (1)' is invoked."



The Applicant responds as follows.

The Examiner's indicated portion of claim 1 has been deleted by the instant amendment to claim 1. Therefore, it is believed that the above-mentioned objection has been removed.

(iv) The Examiner also states that "Claim 3's silicon is not a metal".

The Applicant responds as follows.

In the art, it is known that silicon can be recognized as being a metal. For supporting this contention of the Applicant, the Applicant hereby submits Exhibit 2 which is a copy of "Kagaku Daijiten (Encyclopedia Chimica)" Vol. 3, page 317, edited by the Committee for the Edition of Encyclopedia Chimica, Japan, and published by Kyoritsu Shuppan, Co., Japan (Exhibit 2 has a verified partial English translation thereof attached thereto). Attention is drawn to the fact that Exhibit 2 has a description reading:

"For measuring impurities contained in high purity metallic silicon (for use as a semiconductor), the Hall effect is employed. " (emphasis added) (see page 1, item (2) of the partial English translation of Exhibit 2)

Thus, Exhibit 2 clearly shows that silicon can be recognized as being a metal.

It is believed that the objection to claim 3 (in which silicon is referred to as a metal) has been removed.

Claims 1 and 4 have been rejected under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over the Bostick patent. Specifically, the Examiner states that "Bostick adds octaphenylcyclotetrasiloxane to PC".

**Traverse is made as follows.**

**Bostick** (U.S. Patent No. 3,751,519) discloses a polycarbonate composition consisting of in admixture an aromatic polycarbonate and 0.01-2.0 weight percent of a solid monomeric crystallized **cyclosiloxane** compound selected from the group consisting of phenyl substituted cyclosiloxane and alkyl substituted phenyl substituted cyclosiloxane (see claim 1 of Bostick). Bostick states that "the siloxane employed herein is octaphenylcyclotetrasiloxane." (see column 1, lines 16 to 17 of Bostick)

It should be noted that in the instantly amended claim 1, the aromatic group-containing silicone compound used in the present invention has been limited to an aromatic group-

containing silicone compound having a **linear configuration**.

Therefore, octaphenylcyclotetrasiloxane used in Bostick does **not** fall in the definition of the aromatic group-containing silicone compound used in the present invention.

Further, it should also be noted that in Bostick, the cyclosiloxane compound (i.e., octaphenylcyclotetrasiloxane) is used as a **mold release agent**. This is apparent from, for example, the following description of Bostick.

"Therefore it is an object of this invention to provide a polycarbonate resin having excellent mold release properties." (emphasis added) (see column 1, lines 42 to 44 of Bostick)

Further, attention is drawn to the fact that Bostick has **no** description about flame retardancy.

Thus, Bostick does **not** teach or suggest that the aromatic group-containing silicone compound recited in claim 1 of the present application is effective for **imparting flame retardancy** to an aromatic polycarbonate.

Therefore, Bostick does **not** teach or suggest the process of the present invention for imparting flame retardancy to an aromatic polycarbonate.

The present invention has novelty and inventive step over

Bostick.

Claims 1, 4, 6 to 10 and 12 have been rejected under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over the Bialous patent. Specifically, the Examiner states as follows.

"Bialous exemplifies (III, XVI) adding a flame retardant sulfonate salt and octaphenylcyclotetrasiloxane to PC".

**Traverse is made as follows.**

**Bialous** (U.S. Patent No. 3,971,756) discloses a flame retardant polycarbonate composition of an aromatic polymer in admixture with an organic alkali metal salt or an organic alkaline earth metal salt or mixtures thereof, which composition has in admixture therewith a siloxane.

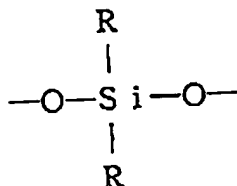
In Bialous, many examples of siloxanes are mentioned which include **cyclic** siloxanes (such as octaphenylcyclotetrasiloxane), **branched** siloxanes (branched methyl phenyl silicone fluid and branched methyl trichlorophenyl silicone fluid), and **linear** siloxanes (i.e., trimethylsilyl terminated methylhydrogensiloxy diphenylsiloxy copolymers).

In the instantly amended claim 1, **cyclic** siloxanes have been

excluded from the aromatic group-containing silicone compound used in the present invention.

Further, needless to say, branched siloxanes are different from the aromatic group-containing silicone compound used in the present invention, which has a linear configuration, but not a branched configuration. In this connection, attention is drawn to the below-quoted description of the present specification.

"Component (B) is at least one aromatic group  
-containing silicone compound selected from the group  
consisting of an aromatic group-containing silicone  
compound having a linear configuration..... Component  
(B) is comprised of D units described in the "Silicone  
Handbook", edited by Kunio Ito and published by The  
Nikkan Kogyo Shimbun Ltd., Japan, (1990), wherein D  
unit is a bifunctional unit represented by the  
following formula (4):



(4).

The silicone compound used in the present invention as component (B) does not contain a unit forming a branched structure or a crosslinked structure. If component (B) contains a silicone compound having a branched structure or a crosslinked structure, component (B) cannot impart a satisfactorily improved flame retardancy to resin component (A)." (emphasis added) (see page 39, line 14 to page 40, line 11 of the present specification)

That is, in the present invention, the silicone compound recited in claim 1 (having a linear configuration) cannot be replaced by a branched siloxane such as described in Bialous.

On the other hand, as mentioned above, in Bialous, as examples of siloxanes, branched siloxanes and **linear** siloxanes are simply described side by side. That is, Bialous **equates branched** siloxanes with **linear** siloxanes.

It should be noted that the use of the aromatic group-containing **linear** silicone compound recited in claim 1 is important to achieving the excellent effects of the present invention, i.e., the effects that the polycarbonate resin composition obtained by the process of the present invention is advantageous not only in that it has excellent flame retardancy and excellent melt-molding stability, but also in that it can be

used for producing a shaped article having excellent mechanical properties, excellent light stability and excellent appearance. In order to substantiate this contention of the Applicant, the Applicant has instantly made observations, with reference to Examples 70 to 77 and Comparative Examples 1 to 11 of the present specification, to show that the use of the aromatic group-containing **linear** silicone compound recited in claim 1 is important to achieving the excellent effects of the present invention. The method and results of the observations are as described in Exhibit 1 of the accompanying Mr. Nishihara Declaration.

As observed in Exhibit 1 of the accompanying Mr. Nishihara Declaration, in Examples 70 to 77 and Comparative Examples 1 to 11 of the present specification (which are, respectively, described at page 82, lines 1 to 12 of the present specification and at page 78, line 15 to page 80, line 4 of the present specification), in accordance with the formulations indicated in Tables 1 and 2 (for Comparative Examples 1 to 11) or in Table 8 (for Examples 70 to 77) (Tables 1 and 2 are present on pages 86 and 88 and Table 8 is present on page 94), the components were mixed with each other by means of a Henschel mixer. Each of the resultant mixtures was individually transferred into a twin-screw extruder, and a continuous melt-extrusion was conducted at 280 °C for 10 hours, thereby obtaining a resin composition. The

obtained composition was subjected to an injection molding under conditions wherein the cylinder temperature was 270 °C and the mold temperature was 60 °C, to thereby obtain shaped articles. The obtained shaped articles were subjected to testings for evaluating the above-mentioned properties. The results of Comparative Examples 1 to 11 are shown in Tables 1 and 2. The results of Examples 70 to 77 are shown in Table 8.

For easy understanding of the data shown in the above-mentioned Tables 1, 2 and 8, the data concerning the type of the organic polymer resin, the structure of the flame retardant (silicone compound) and the amount of an aromatic group is collected from these tables and shown in Table A below. (In each of Comparative Examples 1 and 4, a silicone compound was not used, and only aromatic polycarbonate or only polyphenylene ether was used.)



Table A

	Organic polymer resin	Flame retardant (silicone compound)	
		Structure	Amount of aromatic group
Example 70	PC	linear	25 mole %
Example 71	PC	linear	25 mole %
Example 72	PC	linear	25 mole %
Example 73	PC	linear	25 mole %
Example 74	PC	linear	75 mole %
Example 75	PC	linear	60 mole %
Example 76	PC	linear	75 mole %
Example 77	PC	linear	75 mole %
Comparative Example 1	PC	-	-
Comparative Example 2	PC	linear or cyclic	3 mole %
Comparative Example 3	PC	<b>branched or crosslinked</b> (D units/T units molar ratio: 50/50)	25 mole %
Comparative Example 4	PPE	-	-
Comparative Example 5	PPE	linear or cyclic	25 mole %
Comparative Example 6	PPE	<b>branched or crosslinked</b> (D units/T units molar ratio: 50/50)	25 mole %
Comparative Example 7	PC	linear or cyclic	0 mole %
Comparative Example 8	PC	<b>branched or crosslinked</b> (D units/T units molar ratio: 0/100)	60 mole %
Comparative Example 9	PC	<b>branched or crosslinked</b> (D units/T units molar ratio: 10/90)	60 mole %
Comparative Example 10	PC	<b>branched or crosslinked</b> (D units/T units molar ratio: 50/50)	60 mole %
Comparative Example 11	PC	<b>branched or crosslinked</b> (D units/T units molar ratio: 80/20)	60 mole %

Note: "PC" means aromatic polycarbonate.

"PPE" means polyphenylene ether.

As seen in the above-mentioned Table 8 and in Table A above, the flame retardant ("(B)" component) used in each of Examples 70 to 77 is a silicone compound which satisfies the definition of the aromatic group-containing linear silicone compound recited in claim 1. Specifically, the flame retardant ("(B)" component) used in each of Examples 70 to 77 is comprised only of D units (bifunctional) and has a linear configuration and contains an aromatic group in an amount falling in the range recited in claim 1 of the present application (i.e., 5 to 100 mole %, based on the total molar amount of  $R^1$ ,  $R^2$ ,  $R^3$  and  $R^4$ ).

On the other hand, as seen in the above-mentioned Tables 1 and 2 and in Table A above, Comparative Examples 1 and 4 do not use a flame retardant (silicone compound as "(B)" component). Further, Comparative Example 5 uses a flame retardant (silicone compound as "(B)" component) satisfying the definition of the aromatic group-containing silicone compound recited in claim 1, but the organic polymer resin used in Comparative Example 5 is PPE. Further, the flame retardant ("(B)" component) used in each of Comparative Examples 2, 3, 6 to 11 is a silicone compound which does not satisfy the definition of the aromatic group-containing linear silicone compound recited in claim 1. Specifically, the flame retardant ("(B)" component) used in each of Comparative Examples 2, 3, 6 to 11 is a silicone compound

having a branched or crosslinked configuration or a silicone compound in which the amount of an aromatic group does not satisfy the range recited in claim 1. For example, the flame retardant ("B)" component) used in Comparative Example 3 contains an aromatic group in an amount of 25 mole % (satisfying the range of 5 to 100 mole % recited in claim 1), but has T units (trifunctional) in addition to D units (bifunctional) and hence has a branched or crosslinked configuration. On the other hand, the flame retardant ("B)" component) used in Comparative Example 2 is comprised only of D units (bifunctional) and hence has a linear or cyclic configuration, but the amount of an aromatic group is 3 mole %, which does not satisfy the range of 5 to 100 mole % recited in claim 1. Likewise, the flame retardant ("B)" component) used in Comparative Example 7 is comprised only of D units (bifunctional) and hence has a linear or cyclic configuration, but the amount of an aromatic group is 0 mole %, which does not satisfy the range of 5 to 100 mole % recited in claim 1.

As described below, the results of Examples 70 to 77 and Comparative Examples 1 to 11 clearly show the excellent effects of the present invention. For easy understanding, Table B is shown below, in which the data of the results of the property evaluation (collected from Tables 1, 2 and 8) is combined with the contents of Table A above.

Table B

	Organic polymer resin	Flame retardant (silicone compound)		Evaluation items				
		Structure	Amount of aromatic group	Flame retardancy	Izod impact strength (kg·cm/cm)	Appearance: Yellowness index $\Delta YI$	Light resistance: Difference in color tone $\Delta E$	Extrusion stability: Izod variation percent
Example 70	PC	Linear	25 mole %	O	10	2	2	7
Example 71	PC	Linear	25 mole %	⊙	13	2	2	4
Example 72	PC	Linear	25 mole %	O	15	2	2	5
Example 73	PC	Linear	25 mole %	O	14	2	2	3
Example 74	PC	Linear	75 mole %	⊙	18	3	3	3
Example 75	PC	Linear	60 mole %	⊙	20	4	3	2
Example 76	PC	Linear	75 mole %	⊙	17	4	3	2
Example 77	PC	Linear	75 mole %	⊙	18	3	3	2
Comparative Example 1	PC	-	-	X	15	3	3	5
Comparative Example 2	PC	linear or cyclic	3 mole %	X	7	3	3	29
Comparative Example 3	PC	branched or crosslinked (D units/T units molar ratio: 50/50)	25 mole %	X	5	3	5	33
Comparative Example 4	PPE	-	-	O	7	43	20	9
Comparative Example 5	PPE	linear or cyclic	25 mole %	O	5	44	22	18
Comparative Example 6	PPE	branched or crosslinked (D units/T units molar ratio: 50/50)	25 mole %	O	3	45	25	40
Comparative Example 7	PC	linear or cyclic	0 mole %	X	2	2	2	55
Comparative Example 8	PC	branched or crosslinked (D units/T units molar ratio: 0/100)	60 mole %	X	3	3	4	63
Comparative Example 9	PC	branched or crosslinked (D units/T units molar ratio: 10/90)	60 mole %	X	4	3	4	43
Comparative Example 10	PC	branched or crosslinked (D units/T units molar ratio: 50/50)	60 mole %	X	6	3	5	35
Comparative Example 11	PC	branched or crosslinked (D units/T units molar ratio: 80/20)	60 mole %	X	8	5	6	31

Note: "PC" means aromatic polycarbonate. "PPE" means polyphenylene ether.

In Examples 70 to 77, the evaluation of the flame retardancy is  $\bullet$  or o, indicating excellent flame retardancy (wherein, as described in the Notes for Table 1, the symbol  $\bullet$  means "self-extinguished within less than 20 seconds" and the symbol o means "self-extinguished within 20 to 40 seconds"). Further, in Examples 70 to 77, the Izod impact strength is as high as 10 to 20 kg·cm/cm; the yellowness index  $\Delta YI$  (yardstick of appearance) is very excellent, specifically as low as 2 to 4; the value of difference in color tone  $\Delta E$  (yardstick of light resistance) is very excellent, specifically as low as 2 to 3; and the Izod variation percent (yardstick of extrusion stability) is very excellent, specifically as low as 2 to 7 %.

Thus, in Examples 70 to 77, all properties are excellent.

By contrast, among Comparative Examples 1 to 11, a flame retardancy evaluation of the symbol o (excellent) is obtained only in Comparative Examples 4 to 6, wherein PPE is used. In each of Comparative Examples 1 to 3 and 7 to 11, the flame retardancy evaluation is x, indicating very poor flame retardancy (wherein, as described in the Notes for Table 1, the symbol x means "totally burnt" (not self-extinguished)). Further, Comparative Example 1 (wherein only PC is used and no flame retardant is used) exhibits an Izod impact strength of 15

kg·cm/cm, which is relatively high; however, Comparative Examples 2 to 11 exhibit an Izod impact strength as low as 2 to 8 kg·cm/cm. In Comparative Examples 4 to 6 (wherein PPE is used), the yellowness index  $\Delta YI$  (yardstick of appearance) is very poor, specifically as high as 43 to 45, and also the value of difference in color tone  $\Delta E$  (yardstick of light resistance) is very poor, specifically as high as 20 to 25. Further, in Comparative Example 1 (wherein only PC is used and no flame retardant is used) and in Comparative Example 4 (wherein only PPE is used and no flame retardant is used), the Izod variation percents (yardstick of extrusion stability) are respectively 5 % and 9 %, which are relatively low; however, in Comparative Examples 2, 3 and 5 to 11, the Izod variation percent (yardstick of extrusion stability) is very poor, specifically as high as 18 to 63.

Thus, in any of Comparative Examples 1 to 11, not all properties are excellent and some properties are poor.

Attention is especially drawn to the fact that in any of Comparative Examples 2, 3 and 7 to 11 (wherein PC is used and there is used a silicone compound having a branched or crosslinked configuration or a silicone compound in which the amount of an aromatic group does not satisfy the range recited in claim 1), the flame retardancy evaluation is  $\times$  (indicating very poor flame retardancy), and the Izod impact strength is as low as

2 to 8 kg·cm/cm, and the Izod variation percent is very poor, specifically as high as 29 % to 63 %. That is, all these values obtained in Comparative Examples 2, 3 and 7 to 11 are very poor, as compared to those obtained in Examples 70 to 77.

Therefore, the data of Examples 70 to 77 and Comparative Examples 2, 3 and 7 to 11 of the present specification clearly shows that the use of the aromatic group-containing linear silicone compound recited in claim 1 is critical for achieving the excellent effects of the present invention ( i.e., the effects that the polycarbonate resin composition obtained by the process of the present invention is advantageous not only in that it has excellent flame retardancy and excellent melt-molding stability, but also in that it can be used for producing a shaped article having excellent mechanical properties, excellent light stability and excellent appearance.).

Meanwhile, attention is also drawn to the fact that in Comparative Example 5 (wherein the aromatic group-containing silicone compound recited in claim 1 is added to PPE), the flame retardancy evaluation is 0 (excellent); however, the Izod impact strength is as low as 5 kg·cm/cm, and the yellowness index  $\Delta YI$  (yardstick of appearance) is very poor, specifically as high as 44, and the value of difference in color tone  $\Delta E$  (yardstick of light resistance) is very poor, specifically as high as 22, and the Izod variation percent is very poor, specifically as high as

18 %. That is, all these values obtained in Comparative Example 5 are very poor, as compared to those obtained in Examples 70 to 77.

Therefore, the data of Examples 70 to 77 and Comparative Example 5 of the present specification clearly shows that the excellent effects of the present invention (wherein the aromatic group-containing silicone compound recited in claim 1 is added to aromatic polycarbonate) cannot be obtained by adding the aromatic group-containing silicone compound to a resin (such as PPE) other than an aromatic polycarbonate.

As apparent from the above, the use of the aromatic group-containing linear silicone compound recited in claim 1 is critical for achieving the excellent effects of the present invention.

As also apparent from the above, the flame retardant used in the present invention (the aromatic group-containing linear silicone compound recited in claim 1) is far superior to a flame retardant comprising a branched or crosslinked silicone compound.



Such excellent effects of the present invention are quite unexpected from Bialous, which equates branched siloxanes with linear siloxanes.

Thus, Bialous does not teach or suggest the process of the present invention for imparting flame retardancy to an aromatic polycarbonate.

The present invention has novelty and inventive step over Bialous.

Claims 1 to 4 and 6 to 13 have been rejected under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over the Hamersma patent. Specifically, the Examiner states as follows.

"Hamersma exemplifies (B,C)blends of PBT, PC and aromatic silicone fluid. Glass fibers (col. 3, line 4) can also be included which qualifies as a flame retardant according to applicant (claim 8)."

Traverse is made as follows.

Hamersma (U.S. Patent No. 4,942,188) discloses a polymer mixture comprising a polybutylene terephthalate, an aromatic polycarbonate, and a dialkyl silicone fluid (see the abstract of Hamersma).

In the Comparative Working Examples (B and C) of Hamersma, a methyl phenyl silicone fluid is used. However, the disclosure of Hamersma is nothing more than that.

First, attention is drawn to the fact that Hamersma has no description about flame retardancy.

Further, it should be noted that Hamersma uses a dialkyl silicone fluid in order to obtain a good lacquer bonding. This is apparent from, for example, the following description of Hamersma.

"Due to the presence of the dialkyl silicone fluid compound a good lacquer bonding is obtained."

(emphasis added) (see the abstract of Hamersma)

In addition, it should further be noted that Hamersma has a negative teaching about the use of an aromatic silicone fluid. This is apparent from, for example, the following description of Hamersma.

"It is essential that dialkyl silicone fluids are used; in fact it has been found that an alkylaryl silicone fluid, for example, phenyl silicone ..... do not provide the desired improvement of the bonding."

(emphasis added) (see column 2, lines 53 to 57 of Hamersma)

Thus, Hamersma does not teach or suggest that the aromatic group-containing silicone compound recited in claim 1 of the present application is effective for imparting flame retardancy to an aromatic polycarbonate.

Therefore, Hamersma does not teach or suggest the process of

the present invention for imparting flame retardancy to an aromatic polycarbonate.

The present invention has novelty and inventive step over Hamersma.

Claims 1 to 4 have been rejected under 35 U.S.C. 102(e) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over the Serizawa patent. Specifically, the Examiner states as follows.

"Serizawa exemplifies (C7) a blend of PC with an aromatic polysiloxane".

Traverse is made as follows.

The Serizawa patent (U.S. Patent No. 6,001,921) discloses a flame retardant resin composition comprising a silicone resin having a phenyl group and a non-silicone resin having aromatic ring (such as an aromatic polycarbonate). As apparent from claim 1 of the Serizawa patent, the silicone resin used in the Serizawa patent has both  $R_2SiO_{1.0}$  units and  $RSiO_{1.5}$  units, wherein the  $RSiO_{1.5}$  unit is a T-unit (trifunctional) (see column 6, line 1 of the Serizawa patent). That is, the silicone resin used in the Serizawa patent has a branched structure and, hence, is different from the aromatic group-containing linear silicone compound recited in claim 1 of the present application.

In this connection, it should be noted that the Applicant's

observations made above have substantiated that the flame retardant used in the present invention (aromatic group-containing linear silicone compound recited in claim 1) is far superior to a flame retardant comprising a branched or crosslinked silicone compound. As substantiated by the observations made above, the use of the aromatic group-containing linear silicone compound recited in claim 1 is critical for achieving the excellent effects of the present invention, i.e., the effects that the polycarbonate resin composition obtained by the process of the present invention is advantageous not only in that it has excellent flame retardancy and excellent melt-molding stability, but also in that it can be used for producing a shaped article having excellent mechanical properties, excellent light stability and excellent appearance.

Therefore, the Serizawa patent does not teach or suggest the process of the present invention for imparting flame retardancy to an aromatic polycarbonate.

The present invention has novelty and inventive step over the Serizawa patent.

Claims 1 to 5 have been rejected under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over the Brown patent. Specifically, the Examiner states as follows.

"The reference adds phenyl containing polysiloxane to PC. The amount of aromaticity can vary depending on the value of X and Y.

Regarding claim 3, use of any two polysiloxanes within the scope of the reference would be prima facie obvious (see MPEP 2144.06 "combining equivalents")."

Traverse is made as follows.

The Brown patent (U.S. Patent No. 4,390,651) discloses a polycarbonate composition comprising in admixture an aromatic polycarbonate and a phenyl-containing organopolysiloxane fluid.

However, in the Brown patent, the phenyl-containing organopolysiloxane fluid is used as a mold release agent. This is apparent from, for example, the following description of the Brown patent.

"Small amounts of the present phenyl-containing organopolysiloxanes achieve excellent results of mold release during the molding of the composition."

(emphasis added) (see column 6, lines 4 to 6 of the Brown patent)

Further, attention is drawn to the fact that the Brown patent has no description about flame retardancy. In the working examples of the Brown patent, only the volatility of the phenyl-containing organopolysiloxane fluid (in Example 4) and

the mold release property of the polycarbonate resin composition (in Example 5) are evaluated (see column 7, lines 44 to 47 and column 8, lines 10 to 12 of the Brown patent).

Thus, the Brown patent does not teach or suggest that the aromatic group-containing silicone compound recited in claim 1 of the present application is effective for imparting flame retardancy to an aromatic polycarbonate. As already substantiated by the Applicant's observations made above, the use of the aromatic group-containing linear silicone compound recited in claim 1 is critical for achieving the excellent effects of the present invention, i.e., the effects that the polycarbonate resin composition obtained by the process of the present invention is advantageous not only in that it has excellent flame retardancy and excellent melt-molding stability, but also in that it can be used for producing a shaped article having excellent mechanical properties, excellent light stability and excellent appearance.

Therefore, the Brown patent does not teach or suggest the process of the present invention for imparting flame retardancy to an aromatic polycarbonate.

The present invention has novelty and inventive step over the Brown patent.

Claims 1 to 5 and 13 have been rejected under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35

U.S.C. 103(a) as obvious over the J09087504 patent.

Specifically, the Examiner states as follows.

"The reference adds phenyl containing polysiloxane to PC. The amount of aromaticity can vary depending on the value of X and Y. The polycaprolactone is a polyester.

Regarding claim 3, the use of any two polysiloxanes within the scope of the reference would be prima facie obvious (see MPEP 2144.06 "combining equivalents")."

Traverse is made as follows.

The Applicant submits herewith a verified full English translation of the J09087504 patent as Exhibit 3.

The J09087504 patent discloses a polycarbonate resin composition comprising (A) a polycarbonate resin, (B) a phenyl group-containing silicone oil, and (C) polycaprolactone.

However, in the J09087504 patent, the phenyl group-containing silicone oil is used as a lubricant (sliding property improver). This is apparent from, for example, the following descriptions of the J09087504 patent.

"[Task] It is a task of the present invention to provide a polycarbonate resin composition having excellent sliding properties without a sacrifice of impairing good transparency which a polycarbonate

resin inherently possesses" (emphasis added) (see page 1, the bottom line to page 2, line 3, [Abstract] of Exhibit 3)

"[0004] The present inventors have made extensive and intensive studies toward solving the above-mentioned problems. As a result, the present inventors have found that when a polycarbonate resin is blended with a specific silicone oil and a specific amount of polycaprolactone, a polycarbonate resin having improved sliding properties can be obtained without sacrifice of impairing good transparency which a polycarbonate resin inherently possesses. The present invention has been completed, based on this finding." (emphasis added) (see page 6, paragraph [0004] of Exhibit 3)

Further, attention is drawn to the fact that the J09087504 patent has no description about flame retardancy. In the working examples of the J09087504 patent, only the "Dynamic friction" (yardstick for evaluation of the sliding properties) and the "Light transmission" are evaluated (see page 15, line 3 from the bottom to page 16, line 11, paragraph [0026] of Exhibit 3).

Thus, the J09087504 patent does not teach or suggest that the aromatic group-containing silicone compound recited in claim



1 of the present application is effective for imparting flame retardancy to an aromatic polycarbonate. As already substantiated by the Applicant's observations made above, the use of the aromatic group-containing linear silicone compound recited in claim 1 is critical for achieving the excellent effects of the present invention, i.e., the effects that the polycarbonate resin composition obtained by the process of the present invention is advantageous not only in that it has excellent flame retardancy and excellent melt-molding stability, but also in that it can be used for producing a shaped article having excellent mechanical properties, excellent light stability and excellent appearance.

Therefore, the J09087504 patent does not teach or suggest the process of the present invention for imparting flame retardancy to an aromatic polycarbonate.

The present invention has novelty and inventive step over the J09087504 patent.

Claims 1 to 4 and 13 have been rejected under 35 U.S.C. 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over the Sakano patent. Specifically, the Examiner states as follows.

"Sakano exemplifies (#2,4) blends of PC, polymethylphenyl siloxane and optionally ABS".

Traverse is made as follows.

The Sakano patent (U.S. Patent No. 4,305,856) discloses a thermoplastic resin composition excellent in heat cycle property, which comprises a polycarbonate resin, an ABS type resin and an organo-silicon compound.

In the Sakano patent, the polymethylphenyl siloxane is mentioned as one of the examples of organo-silicon compounds. However, in the Sakano patent, the polymethylphenyl siloxane is used for improving heat cycle property of a plated product produced by plating a molded product of a polycarbonate resin composition. This is apparent from, for example, the following descriptions of the Sakano patent.

"As a result of an extensive study, it has now been found that a thermoplastic resin composition comprising a polycarbonate resin or its blend mixture with an ABS type resin and an organo-silicon compound can afford a molded product suitable for metal plating, and the plated product resulting therefrom shows an excellent heat cycle property." (emphasis added) (see column 1, lines 44 to 50 of the Sakano patent)

With respect to the "heat cycle property", reference is made to the following explanation made in the Sakano patent.

"In metal-plated plastic products, undesirable "blistering" is frequently observed between the surface of the plastic substrate and the metallic film plated thereon. This is because the difference between the plastic substrate and the metallic film in coefficient of linear expansion is so great that they are forced to separate each other due to the change of environmental conditions, particularly the change of temperature. The characteristics of plastics, plastic products or plated plastic products relating to such blistering is called "heat cycle property". (see column 1, lines 10 to 20 of the Sakano patent)

That is, the "heat cycle property" is a capability to suppress "blistering" which is observed between the surface of the plastic substrate and the metallic film plated thereon and which is caused by the large difference in coefficient of linear expansion between the plastic substrate and the metallic film. It is apparent for those skilled in the art that such "heat cycle property" has no relation to the flame retardancy.

In this connection, attention is drawn to the fact that the Sakano patent has no description about flame retardancy. In the working examples of the Sakano patent, only the heat cycle property is evaluated (see Table 1 on the page containing columns 3 and 4 of the Sakano patent).

Further, in the Sakano patent, the polymethylphenyl siloxane is mentioned simply as one of the examples of organo-silicon compounds which include not only aromatic group-containing siloxanes (such as polymethylphenyl siloxane), but also silanes (such as tetraethylsilane) and siloxanes containing no aromatic groups (such as polydimethylsiloxane) (see column 2, lines 49 to 68). That is, the Sakano patent equates aromatic group-containing siloxanes with silanes and siloxanes containing no aromatic groups.

Thus, the Sakano patent does not teach or suggest that the aromatic group-containing silicone compound recited in claim 1 of the present application is effective for imparting flame retardancy to an aromatic polycarbonate. As already substantiated by the Applicant's observations made above, the use of the aromatic group-containing linear silicone compound recited in claim 1 is critical for achieving the excellent effects of the present invention, i.e., the effects that the polycarbonate resin composition obtained by the process of the present invention is advantageous not only in that it has excellent flame retardancy and excellent melt-molding stability, but also in that it can be used for producing a shaped article having excellent mechanical properties, excellent light stability and excellent appearance.

Therefore, the Sakano patent does not teach or suggest the

process of the present invention for imparting flame retardancy to an aromatic polycarbonate.

The present invention has novelty and inventive step over the Sakano patent.

Claims 1 to 4 and 6 to 13 have been rejected under 35 U.S.C. 103(a) as obvious over the Sakano patent in view of EP728811. Specifically, the Examiner states as follows.

"Sakano suggests conventional additives (col 3 line 17) can be included but does not name PTFE or phosphazene flame retardants.

EP 728811 shows PTFE and phosphazene are flame retardants for PC/ABS compositions. It would have been obvious to add PTFE and phosphazene to Sakano's composition for better flame retardancy."

Traverse is made as follows.

As already mentioned above, the Sakano patent has no teaching or suggestion about the process of the present invention and excellent effects achieved thereby.

With respect to EP 728811, as pointed out by the Examiner, this reference discloses a PC/ABS composition containing PTFE and phosphazene as flame retardants. However, EP 728811 has no teaching or suggestion about the use of the aromatic group-containing linear silicone compound recited in claim 1 of the present application. Needless to say, this reference has no

teaching or suggestion about the above-mentioned excellent effects achieved by the use of the aromatic group-containing linear silicone compound recited in claim 1 of the present application.

Therefore, it is apparent that the present invention has an inventive step over the combination of the Sakano patent and EP 728811.

Claims 1 to 4 and 6 to 13 have been rejected under 35 U.S.C. 103(a) as being unpatentable over the Sakano patent in view of Mark. Specifically, the Examiner states as follows.

"Sakano suggests conventional additives (col 3, line 17) can be included, but does not name sulfonic acid salt flame retardants.

Mark shows sulfonic acid salts function as flame retardants for PC. It would have been obvious to add a sulfonic acid salt flame retardant to Sakano's composition for better flame retardancy."

Traverse is made as follows.

As already mentioned above, the Sakano patent has no teaching or suggestion about the process of the present invention, and excellent effects achieved thereby.

With respect to the Mark patent, as pointed out by the Examiner, this reference discloses a PC composition containing a sulfonic acid salt flame retardant. However, EP 728811 has no

teaching or suggestion about the use of the aromatic group-containing linear silicone compound recited in claim 1 of the present application. Needless to say, this reference has no teaching or suggestion about the above-mentioned excellent effects achieved by the use of the aromatic group-containing linear silicone compound recited in claim 1 of the present application.

Therefore, it is apparent that the present invention has an inventive step over the combination of the Sakano patent and Mark.

From the foregoing, it is apparent that any of the cited references has no teaching or suggestion about the essential features of the present invention and effects thereof.

It is believed that the present application is now in condition for allowance.

Reconsideration and early favorable action on the claims are earnestly solicited.

Pursuant to 37 C.F.R. §§ 1.17 and 1.136(a), Applicant respectfully petitions for a one (1) month extension of time for filing a reply in connection with the present application, and the required fee of \$110.00 is attached hereto.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact John W. Bailey (Reg. No. 32,881) at the telephone number of the undersigned below.

Attached hereto is a marked-up version of the changes made to the application by this Amendment.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By 

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JWB:bmp  
0216-0445P

Attachments:

Version with Markings to Show Changes Made

Unexecuted 37 C.F.R. 1.132 Declaration of Mr. Nishihara  
(including **Exhibit 1**)

Partial Verified English Translation of "Kagaku Daijiten  
(Encyclopedia Chimica)" Vol. 3, page 317 (**Exhibit 2**)

Full Verified English Translation of JP 09-087504 (**Exhibit 3**)  
(Rev. 02/20/02)



VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claims 6-12 have been canceled.

The claims have been amended as follows:

Claim 1. (Amended) [An aromatic polycarbonate resin composition comprising:

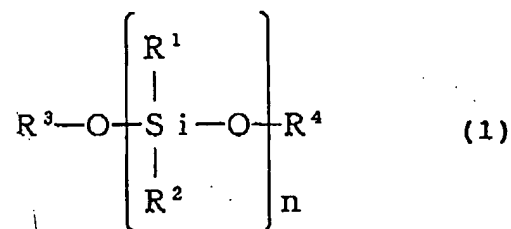
100 parts by weight of] A process for imparting flame retardancy to a resin component [(A)] selected from the group consisting of an aromatic polycarbonate and a resin mixture of an aromatic polycarbonate and at least one organic polymer resin other than an aromatic polycarbonate, wherein said resin mixture has an aromatic polycarbonate content of 50 % by weight or more, [and]

[0.1 to 100 parts by weight of at least one aromatic group-containing silicone compound (B),]

said process comprising adding to said resin component a flame retardant comprising at least one aromatic group-containing silicone compound, wherein said flame retardant is added in an amount of 0.1 to 100 parts by weight, relative to 100 parts by weight of said resin component,

said at least one aromatic group-containing silicone compound [(B)] comprising a monomer, a polymer or a mixture thereof, which is represented by [at least one formula selected

from the group consisting of] the following formula[e] (1) [and (2)]:



wherein:

each of  $\text{R}^1$  and  $\text{R}^2$  independently represents a hydrogen atom or a monovalent  $\text{C}_1\text{-C}_{20}$  hydrocarbon group;

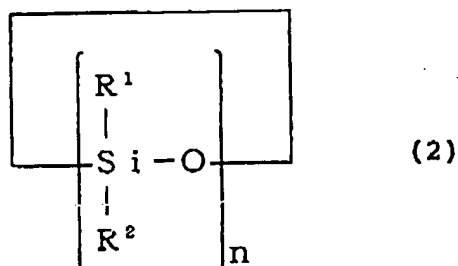
each of  $\text{R}^3$  and  $\text{R}^4$  independently represents a hydrogen atom; a monovalent  $\text{C}_1\text{-C}_{20}$  hydrocarbon group; a metal-containing monovalent group comprising a metal atom having bonded thereto at least one member selected from the group consisting of a hydrogen atom and monovalent  $\text{C}_1\text{-C}_{20}$  hydrocarbon groups; [or a divalent  $\text{C}_1\text{-C}_{20}$  hydrocarbon group, wherein, when each of  $\text{R}^3$  and  $\text{R}^4$  independently represents a divalent  $\text{C}_1\text{-C}_{20}$  hydrocarbon group,  $\text{R}^3$  and  $\text{R}^4$  are bonded to each other to form a ring;]

at least one of  $\text{R}^1$ ,  $\text{R}^2$ ,  $\text{R}^3$  and  $\text{R}^4$  is a  $\text{C}_6\text{-C}_{20}$  aromatic group having a valence according to the

definition of  $R^1$ ,  $R^2$ ,  $R^3$  or  $R^4$ ; and

$n$  is 1 or more in terms of the number average  $n$  value,

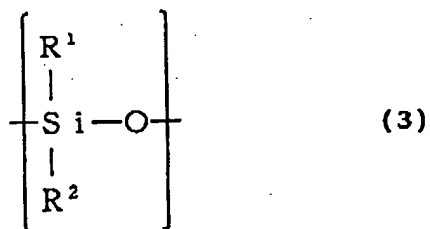
[and



wherein each of  $R^1$ ,  $R^2$  and  $n$  is as defined for formula

(1),]

wherein, when said [component (B)] flame retardant is a polymer represented by formula (1) [or (2)] wherein  $n$  is 2 or more in terms of the number average  $n$  value, the recurring units, each represented by the following formula (3):



wherein each of  $R^1$  and  $R^2$  is as defined for formula

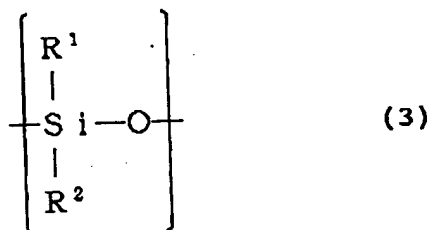
(1),

are the same or different, so that said [polymer (B)] flame retardant is a homopolymer or a copolymer, wherein said copolymer has a random, a block or an alternating configuration, and

[wherein, when each of R<sup>1</sup> and R<sup>2</sup> of formula (2) is a hydrogen atom or an aliphatic hydrocarbon group, at least a part of said component (B) is a compound represented by formula (1), and]

wherein said [component (B)] flame retardant contains said aromatic group in an amount of 5 to 100 mole %, based on the total molar amount of R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup> and R<sup>4</sup>.

Claim 2. (Amended) The [polycarbonate resin composition] process according to claim 1, wherein said metal-containing monovalent group as at least one of R<sup>3</sup> and R<sup>4</sup> is represented by the formula:



wherein M represents a tetravalent metal atom, and each of R<sup>5</sup>, R<sup>6</sup> and R<sup>7</sup> independently represents a hydrogen atom or a monovalent C<sub>1</sub>-C<sub>20</sub> hydrocarbon group.

Claim 3. (Amended) The [polycarbonate resin composition] process according to claim 2, wherein M represents a silicon atom.

Claim 4. (Amended) The [polycarbonate resin composition] process according to any one of claims 1 to 3, wherein said [component (B)] flame retardant exhibits a kinematic viscosity of 100 centistokes or more as measured at 25 °C in accordance with JIS-K2410.

Claim 5. (Amended) The [polycarbonate resin composition] process according to any one of claims 1 to 3, wherein said [component (B)] flame retardant comprises a mixture of:

a silicone compound containing said aromatic group in an amount of from 5 to less than 50 mole %, based on the total molar amount of R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup> and R<sup>4</sup>, and

a silicone compound containing said aromatic group in an amount of 50 mole % or more, based on the total molar amount of R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup> and R<sup>4</sup>.

Claim 13. (Amended) The [polycarbonate resin composition] process according to claim 1, wherein said resin component [(A)]

is a resin mixture of an aromatic polycarbonate and at least one organic polymer resin selected from the group consisting of aromatic vinyl polymers, olefin polymers, polyesters, polyamides, polyphenylene ethers and epoxy polymers.